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The Kiln Room

Some Financial Considerations

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This is Part 1 of an article by C. H. Sonntag. Part 2 will appear in the July issue of the Cement Mill Section of CONCRETE.

The kiln room of a cement plant is to most people the part of greatest attraction and interest. It is the most spectacular, and, especially when waste heat boilers are in operation, makes up a rather impressive collection of mechanical equipment. But to the man who is responsible for its operation its chief importance lies in the fact that in this department is spent a considerable part of the money that represents the manufacturing cost of a barrel of cement.

There have been many printed discussions of kiln and waste heat boiler practice, but for some ill-defined reason they have been mostly confined to descriptions of installations and statements of qualitative facts and observations. These have been wonderfully interesting to the cement technician, but the manager who must think in terms of dollars and cents as well as output will usually look in vain for information that will help him with his particular problem. One recent paper[1] has crossed the dividing line between the technical and the financial, and it is hoped that others will do so. In an effort to give further discussion a trend in this direction the following remarks on kiln and waste heat practice are submitted.

In a quantitative treatment of any subject one must start out with certain known or assumed facts. In what follows this has been done, but as outputs, fuel consumption, temperature and other operating figures are not the same in any two mills, definite quantities are assumed to start with, not because they represent the actual practice in any particular plant, but rather to give a concrete example on which to base an argument. Any cement man can substitute the figures pertaining to his own mill and get results directly applicable to his special case.

Each subject is treated rather independently of others, but they can be easily combined if they should be considered together in the study of any one mill.

In order to avoid repetition, let us assume the following data to apply throughout this paper, unless definitely changed under some particular heading:

(1) That a kiln operates at the rate of 1000 bbls. per day for 45 weeks per year, making a total of 315,000 bbls. of clinker in 315 working days.

(2) That coal costs $5.00 per net ton delivered, and 50c per ton for pulverizing, making coal ready for the kiln cost $5.50 per ton, or $.00275 per lb.

(3) That the kiln uses coal at the rate of 130 lbs. per bbl. of output. This will not apply to the Lehigh Valley mills, nor to others using an almost natural mix, but it will be near the truth for wet process mills and those using pure limestone and clay or shale.

(4) That the mill cost is $1.30 per bbl. and the overhead expense 40c per bbl., making a total of $1.70, so that the mill cost of the product of one kiln for one year will be $409,500, and the overhead cost $126,000.

(5) That the power required is 16 kw. hours per bbl.

(6) That the selling price is $2.00 per bbl. in bulk at the mill.

THE VALUE OF THE ROTARY COOLER

If an existing mill has no rotary coolers it will usually be difficult or practically impossible to install them, and on the other hand if they are in use it may be equally hard to get rid of them. What follows will therefore apply more especially to new construction or extensive remodeling.

Let us base our calculations on these assumptions:

(a) That a cooler will effect a saving of 5% in kiln fuel by returning to the kiln in the form of heated air 5% of the total heat required[2].

(b) That a cooler can be installed complete ready to run for $20,000.

(c) That interest, depreciation, obsolescence and taxes amount to 20%.

(d) That repair material and labor and lubrication cost $500 per year.

(e) That the cooler will be worked at the rate of 1000 bbls. per day or 315,000 bbls. per year, the same as the kiln to which it is connected.

(f) That 4 hours operating labor per day at 35c per hour are chargeable to it.

(g) That power is consumed at the rate of 15 h. p. or 12 kw. at 1.5c per kw. hour.

(h) That because of unavoidable cooler shut-downs, it causes a loss of time to its kiln of one hour per week, or 45 hours or 1875 bbls. a year.

Since these 1875 bbls. are not burned, the corresponding amount of fuel will not be used, amounting to 1875 x 130 x $.00275 = $670.31.

This subtracted from the original assumed yearly cost of $535,000 leaves $534,829.69.

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[1] The Economic Limit and Operating Flexibility of Waste Heat Boiler Installations, by Helmuth Krarup, read before the annual meeting of the Portland Cement Association, Nov. 18, 1924.

[2] This is a fair average value deduced from Mr. S. H. Harrison's "Notes on the Preheating of Air for Rotary Kilns," published by the Committee on Conservation, Portland Cement Assn. in 1921.

This amount will have made only 315,000—1875 or 313,125 bbls.

$534,829.69÷313,125=$1.708.

That is to say, the shut-downs due to the cooler have independently of other considerations increased the cost of the product by .8c per bbl.

The only saving that has been adduced in a quantitative way for the rotary cooler is that of kiln fuel. In the case in question this would be

130 x .05 x $.00275=$.0179

Against this we have to charge the various expenses listed above, which would itemize:

(c) Interest, depreciation, obsolescence and taxes, $20,000 x .20=	$4000.00
(d) Repairs and lubrication	500.00
(f) Operating labor, 4 x 7 x 45 x $.35=	441.00
(g) Power, [(12 x 24 x 7 x 45)—50] x $.015=	1360.05
(h) Shut-downs, 313,125 x $.008=	2505.00
Charge against cooler operation for one year	$8806.05

Charge per barrel, $8806.05÷313,125=$.0281

Against this we have made an assumed fuel saving of 1.79c, leaving a net operating expense for running the cooler of 2.81c—1.79c or 1.02c per barrel.

In a year this will amount to

313,125 x 1.02c..........$3,193.88

In this study two items have not been considered because they do not appear as direct expense, but they are none the less real for all that.

First, the investment in the cooler should not only carry itself, but should earn at least 15%. As on the basis of the above calculation this is not done, cooler operation should be charged with this item, which would amount to

$20,000 x .15=..........$3,000.00

Second, our production has been decreased 1875 bbls., which could presumably have been sold at a profit of 30c per bbl. There has then been a direct loss of profits of

1875 x $.30=..........$562.50

It would seem safe to say then that in this theoretical case the use of one rotary cooler has cost in

Direct operation expense	$3,193.88
Loss of earning on investment	3,000.00
Loss of anticipated profit on sales	562.50
Making a total of, per year	$6,756.38

Air Supply to Kilns

To efficiently burn the fuel in a kiln requires the admission of air in a fixed ratio to the fuel supply, regardless of whether this air is forced in by a blower or drawn in by the draft of the kiln.

In the case of kilns still operating on natural draft the capacity is definitely limited by the weight of gas that will flow up the stack, as this determines the amount of fuel that can be burned without the formation of carbon monoxide. If the fuel is blown in with just enough air to get it into the kiln, say 20 or 25% of that needed for combustion, the rest of the required air must be drawn in around the hood by the stack draft. Now assuming a constant stack temperature, the friction or loss of head experienced by the stream of gas passing through the system depends on the rate at which it flows. That is to say, the weight of gas flowing in unit time may be so great that too much of the stack draft is used up in the friction of flow, and not enough suction is left available at the fire end of the kiln to draw in more air. We can say then that the work of the stack may be divided into three parts, one producing flow through the kiln and stack considered as a flue, another overcoming the friction of entry of air between the kiln and hood and through the clinker chute, and a third in accelerating the velocity of the air and gas from zero to the average existing in the kiln and stack.

Now the volume of gas that will pass through the system may be increased by overcoming the friction of entry by some external source of power, which will also do much of the work of acceleration, leaving the stack draft to be used mostly in overcoming the friction in itself and the kiln only. This can be done by blowing into the kiln a larger volume of air, preferably mixed with the coal, which will call for a larger blower and more power to drive it, and larger air and coal pipes and injectors.

For the sake of getting a definite basis for calculation, let us assume the following conditions:

Per Cent Air blown in	Daily output	Coal per bbl.	Blower power	Investment in blower motor, piping, etc.
25%	750 bbls.	105 lbs.	12 kw.	$550
50	900	115	20	950
65	1000	130	28	1300

As the kilns have natural draft, power must be made by burning coal under boilers, and we may take its cost at 1.5c per kw. hour.

It will be necessary to assume that the production of the entire mill varies with that of the kilns. The only way this could be avoided would be to operate a sufficient number of kilns to keep the mill output constant, and many mills are not in position to do this.

As the mill output goes down, the cost of repair material for grinding machinery will go down about proportionately, but not that on elevating and conveying equipment. As to labor, a certain number of men must be kept on hand, both for operation and repairs, and it is doubtful whether this number could be materially reduced if the change in production were no greater than we are now considering. No account of the first cost of the raw material is taken as it is such a variable item, but it should be figured in an exact study.

The overhead expense of $126,000 will be practically fixed, and must be apportioned to the yearly production, whatever that may be.

The power used will remain roughtly at 16 kw. hr. per bbl. but the cost of that power per kw. hr. will go up as the amount generated is reduced. The power-hourse is a factory making energy, and when it is in operation about the only expense that will vary with production is fuel. All the other expenses are practically fixed, so that as the amount of power made goes down the cost per unit will go up.

A coal rate of 3 lbs. of $5.00 coal per kw. hr. means that each kw. hour costs .75c for fuel, which will be constant if we neglect the change in efficiency of the power-house machinery with change of load. This leaves the other .75c as a fixed expense.

The yearly output of the kiln and the power required in the mill at the assumed rates will be:

Bbls. per day	1,000	900	750
Bbls. per year	315,000	283,500	235,250
Kw. hr. per year	5,040,000	4,536,000	3,780,000

The power used at the 1000 bbl. rate will cost

5,040,000 x $.0075=$37,800 for fuel and the same amount for fixed charges, or a total of $75,600.

At the 900 bbl. rate the power will cost

(4,536,000 x $.0075)+$37,800=$71,820, which divided by 4,536,000 gives $.01583 as the cost of one kw. hr.

In the same way the power at the 750 bbl. rate can be shown to cost $66,150 or $.0175 per kw. hr.

The kiln fuel at the 1000 bbl. rate will cost:

130 x .00275=$.3575 per bbl., or $112,612.50 per year.

Subtracting this from the mill cost of $409,500 leaves $296,887.50.

Subtracting from this the power charge of $75,600 leaves $221,287.50 as a sort of basic expense that is roughly applicable as a lump charge regardless of reasonable variations in output.

We are now in position to make a rough calculation of the cost of making 900 bbls. daily for an operating year, and to ascertain the net effect on the financial return by doing so, all as compared with production at the rate of 1000 bbls. per day per kiln.

The 900 Barrel Rate

	per year	per bbl.
Basic Mill expense	$221,287.50	78c
Fixed overhead	126,000.00	44
Kiln Fuel, 115x283,500 x $.00275	89,656.88	31.6
Power	71,820.00	25.3
	$508,764.38	

We have saved 8 kw. in blower power, which would have cost us per year 8 x $.01583 x 24 x 315 = $957.60.

We have also saved 20% carrying charges on the difference between $1,300 and $950 blowing equipment investment, amounting to $350 x .20 = $70.00.

The saving on these two items is $957.60 + $70.00 = $1027.60.

Subtracting this from the cost derived above leaves as the net cost $508,764.38—$1027.60 = $507,736.78.

If the selling price remains at $2.00 per bbl the returns from sales will be $2.00 x 283,500 = $567,000.00.

The profit will be $567,000.00—$507,736.78 = $59,263.22.

At the 1000 bbl. rate the profit would have been $94,500.00.

It appears then on the basis of the above figures that in order to lower the rate of kiln fuel per bbl. we have sacrificed $94,500.00—$59,263.22, or $35,236.78 in actual money return.

The 750 Barrel Rate

Let us consider now the effect of further fuel conservation by operating the kiln at 750 bbl. per day at 105 lbs. of coal per bbl.

	per year	per bbl.
Basic mill expense	$221,287.50	93.7
Fixed overhead	126,000.00	53.3
Kiln fuel 105 x 236,250 x $.00275	68,217.19	28.9
Power	66,150.00	28.0
	$481,654.69	

We have saved 16 kw. in blower power which would have cost us per year 16 x 24 x 315 x $.0175 = $2,116.80.

We have also saved 20% carrying charges on the difference between $1,300 and $650 blowing equipment investment, amounting to $650 x .20 = $130.00.

The total saving on these items is $2,116.80 + $130.00 or $2,240.80.

Subtracting this from the cost derived above leaves as the net cost $481,654.69—$2,240.80 = $479,413.89.

If the selling price remains at $2.00 the returns from sales will be $2.00 x 236,250 = $472,500.00.

The cost of manufacture being $479,413.89, there will be a loss on the year's operations of the difference between the last two amounts, or $6,913.89, instead of the profit of $94,500 that we would have had if we had continued to push our kilns to a production of 1000 bbls. per day.

The foregoing is not a rigidly accurate calculation of costs under the assumed conditions. For one thing, no account has been taken of the value of the raw materials at their source, which would be a fixed sum per barrel, not varying greatly with production. However, the value of the ingredients in the ground is very small, increasing only as work is done on them, and this work, if done at all, will cost about the same regardless of minor changes in output. Also the saving in blower power is taken at a high figure. It is likely that the cost of this would be reduced by only the fuel item of the power cost, or less than half of the assumed saving. There will be other minor variations in cost that will be more or less proportional to production, but they are too small to have any material bearing on the result.

Because of its lack of strict accuracy, accountants will take exception to this method of figuring, and it is freely admitted that the right way to do it is to take the mill cost sheet for an entire year, assume a definite increase or decrease in kiln output, and on this basis calculate a new value for each item. These when expressed in dollars per year, added together and divided by the new production will give the new mill cost. Items of overhead expense can be treated in the same way if it is not desired to handle them in a lump sum. Then bearing in mind the change in proceeds from sales with variation in production, a very close estimate of the change in earnings can be arrived at.

The foregoing has been worked out with the understanding that we are able to feed each kiln at the rate of 1000 bbls. a day and grind all the clinker it makes. The problem may be approached from the other end—that is, we may have a kiln making 750 or 900 bbls. a day and wish to know what will be the financial result of forcing it to the 1000-bbl. rate. Here the matter may not be so simple, for we may not have enough raw or finish grinding machinery to handle the required material. We may also be short of power. In such a case a careful study will be pretty certain to show that the installation of the necessary machinery will be an excellently well paying investment.

The financial advantage of forcing the kilns of a small plant to greater production is not a matter of theory only. The writer knows by actual operating experience not only that it can be done, but that it pays handsomely in a small mill, and for this reason he has long been advocating it both in print[3] and in conversation. A study of the subject from the view-point of the larger plant is taken up later in this paper.

One way to increase the potential capacity of a kiln is the use of a good seal ring around the feed end. This is a device that did not receive a great deal of consideration until the advent of waste heat boilers, but it must be remembered that when a large opening exists around the end of the kiln much of the work the stack can do is expended in drawing cold air through this opening. If it is closed the energy wasted because of it is available to increase gas velocity in the kiln, which will allow more coal to be burned and more clinker made.

The use of a seal ring has one disadvantage. As long as there is an opening around the end of the kiln the burner can always tell when he is blowing in too much fuel, for he can see the characteristic bluish flame of carbon monoxide. With the seal ring in place, gas analysis or pyrometer indications must be relied upon for this information.

In order to blow a larger proportion of the air for combustion in with the coal the use of larger air pipes, coal injectors and coal pipes to the kiln are requisite. A more powerful blower will also be needed if the one in use is already worked to capacity. A little experimenting may be necessary to select the proper size of coal pipe, for if it is too small the mixture will enter the kiln with too much velocity, and there will be a tendency for the fire to leave the hood. On the other hand, if the coal pipes are too large the mixture will be moving so slowly when it enters the kiln that the flame will be too close to the hood, and damage to the brick will follow. One or two trials will suffice to select pipe of the proper size.

This analysis of kiln operation in a small mill brings out forcibly the following points:

(a) The mill cost per barrel goes up rapidly as production decreases, in spite of a lower coal consumption per barrel in the kiln.

(b) Overhead expense per barrel increases at almost the same rate as production falls off.

(c) For every barrel of cement that could be made and sold and is not, there is a direct loss of the possible profit on that barrel.

Cement From Sea Mud

Two French engineers, Messieurs Perrineau and Robert, have been experimenting with the sea muds in the estuaries of the Loire and the Gironde. They found that if dried by exposure to air, or in kilns, freed from sand and organic (vegetable) matter and then finally ground, the resulting powder can be added in large proportions to suitable lime for the manufacture of cements. Such cements are slow setting, show a high resistance to atmospheric moisture and water, and are highly impermeable.—*Genie Civil.*

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[3] *Cement Era*, Sept. 1915, p. 66.

Coyote Hole or Tunnel Blasting

By George E. Willman

From *Explosives Service Bulletin,* E. I. du Pont de Nemours & Co., Inc.

Coyote hole blasting is one of the oldest known methods of blasting where large quantities of rock are to be moved. The quarries in the West today break more stone by coyote hole blasting than by any other method.

Except in rare instances, coyote hole blasting is not the most economical method of blasting from a standpoint of explosive cost, but on many projects there are other factors to be considered that are far more important than the breaking of a given amount of rock with the smallest possible quantity of explosives. Railroad and highway construction must often proceed in advance of wagon road construction through a country the topgraphy of which prohibits the economical transportation of heavy drilling machinery. In such a case, light camp and drilling equipment can be installed and two or three men can drive the coyote holes in advance of the time when the stone will be required. On some contractors' operations, water and fuel must be hauled long distances. By use of the coyote hole method, consumption of fuel and water can be kept at a minimum and the rock can be broken for a smaller total cost than by any of the other methods in use. Sometimes the size of the job does not warrant the contractor's grading the rugged top of a quarry for setting up a well drill. Here again the coyote hole is the most feasible method to use. When a well drill is used to drill rock that is checked into small cubes, the jar of the drill may loosen some of these cubes from the sides of the hole and allow them to fall into the hole on top of the drill. The drill then sticks fast and it may be necessary to sink a shaft to recover the drill stock.

A coyote blast lifts the stone several feet and rolls it forward from the face of the quarry, producing a grinding, crushing effect. A hole can be so loaded that a maximum amount of crusher size rock is produced and little secondary blasting is necessary.

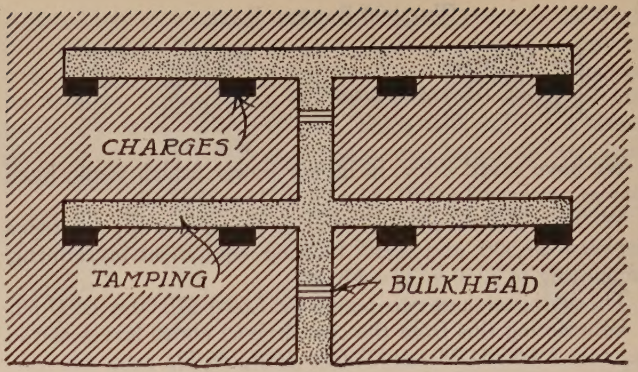


Fig. 1—Plan view of tunnels for coyote blasting showing offsets for powder pockets

Preparing the Coyote Hole

The quarry is first examined carefully to determine the most advantageous point for placing the charge. A small tunnel is then driven into the rock at the point selected. The cross-section of such a tunnel is generally about 3½ ft. × 3½ ft., or smaller if possible, and the length should usually be about equal to the average height of the rock over the tunnel. At the end of this tunnel and at right angles to it, a crosscut is driven from each side. These crosscuts are generally spoken of as T's. The combined length of the two T's should be approximately the same as the length of the main tunnel. At the end of each T a pit is sunk sufficiently large to accommodate the explosive charge below the level of the floor of the T. These pits are generally referred to as powder pockets. Sometimes an offset for the charge is driven on the same level as the crosscut or the explosive is simply placed on the floor of the crosscut, but in my experience the better confinement of the charge provided by the sunken pit always leads to better breakage.

When the requirement for a large quantity of material necessitates driving the main tunnel so long that it is out of proportion to the height of the quarry, two or more pairs of T's are used to distribute the explosive charge properly. This is also necessary at times when blasting in a blocky formation. Frequently when the rock is hard and high fragmentation is desired two or more powder pockets are placed in each crosscut at distances of from 15 to 25 ft. apart.

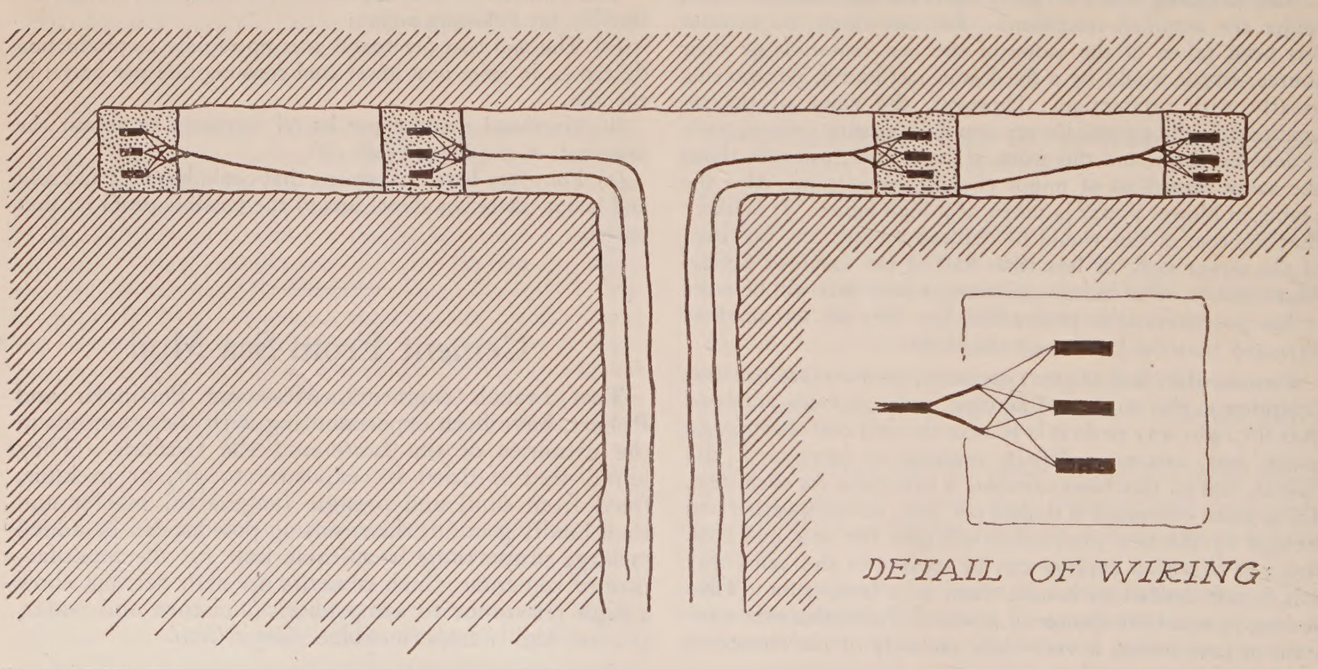


Fig. 2—Method of connecting detonators in a coyote hole

SELECTION OF THE EXPLOSIVE

The selection of the explosive is governed largely by local conditions, the structure of the material to be blasted and the purpose for which the broken material is to be used. I have loaded and fired coyote holes with Judson powder, 20% straight dynamite, 20% stumping powder, 17% Repauno stumping powder, 40% and 60% straight dynamite, 40% and 60% Red Cross extra dynamite and Pacific stumping powder primed with 40% straight dynamite, but the most satisfactory results were obtained from the use of a coarse-grained black blasting powder primed with from 5 to 10% of its weight of 40% or 60% straight dynamite.

EXPLOSIVE CHARGE REQUIRED

The size of the explosive charge is governed by the amount of material to be broken, the nature of the material and the purpose for which it is to be used, as well as by any local conditions that it may be necessary to consider.

In estimating the size of the charge, the first step is to determine the amount of material lying directly over the tunnels or, as many quarrymen express it, "the yardage in the square of the shot." This is calculated by taking the length of the main tunnel in feet, multiplying by the combined length of the two T's in feet, multiplying again by the average thickness of the material overlying the tunnel in feet, and dividing this product by 27 to reduce to cubic yards. A well gauged coyote shot will usually break almost twice the yardage contained in the square of the shot, but this figure gives a basis from which to work. If the material is to be crushed for road surfacing, the charge may vary all the way from three-tenths of a pound to a pound and a half of explosive to the cubic yard of material in the square of the shot. If it is desired to waste the material, that is throw it clear of the right of way in side hill road construction, the explosive charge may run from a pound and three-quarters to three and a half pounds to each cubic yard in the square of the shot. For a shot for this purpose it is better to err on the side of overloading rather than underloading. A good coyote shot will throw from 60 to 80% of the material clear of the right of way.

LOADING THE HOLES

The following method is usually followed in loading coyote holes. One 50-lb. case of 40% straight dynamite is placed in the bottom of a powder pocket. Three of the cartridges in the box are each primed with an electric blasting cap. The cap wires are well scraped and the caps are connected in series. Each of the free cap wires is then connected to one of the wires in a 14 gauge duplex copper leading wire running out of the tunnel to the face of the quarry, all joints are well taped and the leading wire is wrapped in heavy roofing paper or gunny sacks to protect it from sharp rocks.

The explosive charge that has been decided upon is then loaded in the pocket on top of the primer. If the size of the pocket permits, it is usually preferable to load the explosive in the original packages. This not only saves time but is safer, as it eliminates any opening of packages and any handling of loose explosives. In loading blasting powder in a side hill coyote hole to waste the material it is better to open the keg and pour the powder out into the pocket. When the charge is in place, it is covered with dry earth or screening from the broken rock excavated from the tunnel. The other pocket is primed and loaded in exactly the same manner. The electric blasting caps in this pocket, after being connected in series, are connected in the same way to a second duplex leading wire running out of the tunnel to the face of the quarry. When ready to fire, one wire from the pocket on the right is connected with a wire from the pocket on the left and the two free wires are connected to the leading wires running to the blasting machine, thus making a complete circuit.

If there are more than two explosive units, each one is primed in the same manner with its own leading wires running out to the face. By this method the circuit in each pocket can be tested separately with the galvanometer and all possible connections are in the open. To make sure of the detonation of all the charges with maximum effect, it is a good practice to run a line of cordeau from unit to unit with a coil of cordeau on the bottom of each pocket. With the explosion of any one charge, the cordeau will be set off and will carry the detonation to the other charges. Countered cordeau should be used.

When both powder pockets have been loaded and the charges covered, the T's and tunnel are filled with the broken stone accumulated from the driving of the tunnel. This should be tamped solidly in place. Sometimes timbers or logs are used to aid in confining the filling in the T's. Green fir logs about 12 in. in diameter are most often used for this purpose. A row of these is laid down crosswise on the floor at the end of the tunnel with the ends projecting into each crosscut. The crosscuts are tamped tightly right up to the ends of the logs and all space between the logs is carefully filled with fine earth. A second layer of logs is then laid on the first and the process repeated until the logs reach the top of the tunnel. The main tunnel is then tamped up in the usual manner. The wires are connected as already described and when everyone has reached a place of safety, the blasting machine is connected and the blast is fired.

PRECAUTIONS TO BE OBSERVED

Reduce the number of men handling explosives to the smallest possible number. A small number of men can be more easily watched than a larger number.

Allow no smoking.

Allow no matches on the job.

Insist that the explosives be handled carefully.

Insist on the men wearing rubber shoes or rubbers, or wrapping their shoes in gunny sacks.

Do not hurry.

Do not allow bare ends of wire to touch the ground. Tape over the bare ends of the wires.

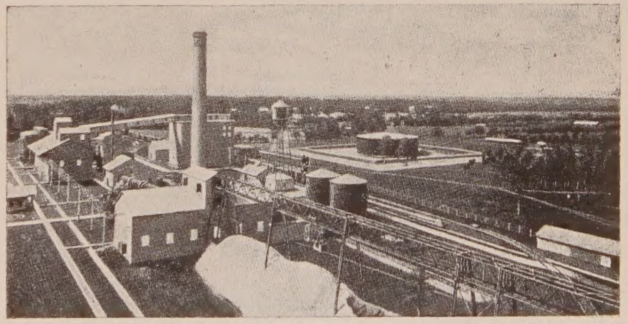
Do not allow flashlights to come in contact with the wires.

Before firing the shot be sure everyone is well away from the blast and that all roads leading to or near the blast are patrolled and traffic stopped.

Last but not least, do not allow anyone to rush back to the blast immediately after it has been fired.

International Corporation Active

The sixth annual report of the International Cement Corp. for the period ending December 31, 1924, shows a net consolidated income for the year, after Federal income taxes, depreciation and depletion reserves, amounting to $3,047,506.90 as compared with $2,422,577.31 for the year 1923. Allowing for preferred dividends paid this net income is equivalent to approximately $7.14 per share on the 400,000 shares of common stock outstanding at the close of the year, as compared with $6.37 per share on the 364,167 shares outstanding at the close of the previous year.



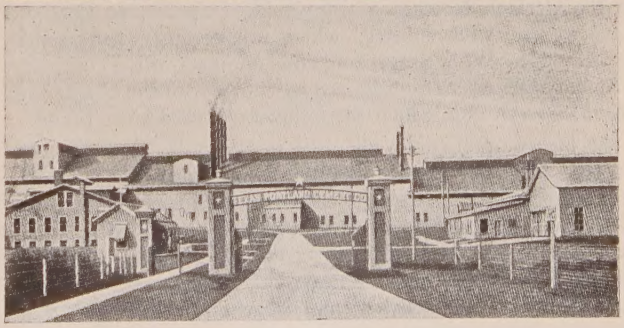


Fig. 1—General view of Houston plant of Texas Portland Cement Co., a subsidiary of the International Cement Corporation. Raw material storage in the foreground

Fig. 2—General view of Dallas plant, showing east entrance to the plant

The comparative balance sheet given as part of the president's report shows the company to be in strong financial position, free from all mortgage indebtedness, with net quick assets of approximately $4,300,000.

Expenditures for Capital Assets consisted of completion of the Kansas plant; completion of the enlargement of the Cuban and Houston plants; the acquisition of a plant site and mill with adequate supply of suitable raw material near the City of Norfolk, Va., and the beginning of the construction of a modern mill with productive capacity of one million barrels per annum and sundry expenditures and installations at the other properties, particularly the enlargement of the Argentine and Uruguay plants.

As a result of the foregoing expenditures, the company at the end of 1924 had an annual productive capacity of approximately seven million barrels or over one million barrels in excess of that at the end of the previous year. With the completion of the Norfolk plant, which is expected in August of the current year, and the additional improvements at the foreign plants, the productive capacity of the company is estimated at approximately 8,500,000 bbls. per annum.

During the year 1924, all of the plants were operated at full capacity and although the net price realized in the market served by the various subsidiary companies was somewhat reduced, the entire tonnage was disposed of at a fair margin of profit due to lower production costs.

In Cuba, the demand for production has increased to such an extent that it has been deemed advisable and necessary to increase the capacity again, and it is hoped by the company that the increased tonnage will be available sometime the latter part of 1925.

Conditions in Argentine and Uruguay have continued to improve and the enlargement of these two properties which was started last year will be completed some time during the current year giving the benefit of increased tonnage which should be reflected not only in production costs but also in the earnings of these two companies.

Up to December 31, 1924, the International corporation increased its productive capacity by approximately 150% with an increase of approximately 75% in common stock and an issue of $3,411,800 of preferred stock, compared with a total liquidation and retirement of $3,649,524 in funded indebtedness and notes payable.

Oil Engines as Prime Movers

The accompanying illustrations show interesting features in the Gerlach, Nevada, gypsum mill of the Pacific Portland Cement Co., Consolidated, which was recently described in an article[1] by W. S. Stevenson, chief engineer of the company. The illustrations are reproduced by courtesy of the *Compressed Air Magazine* from which the following excerpts are taken.

As far as practicable, all units in the mill are direct connected and individually driven. Spur-gear speed transformers, manufactured by Foote Brothers Gear & Machine Co., make this individual drive possible and likewise assure economy in space requirements. The vital matter of safety-first has been carefully considered and provided for. All running parts are guarded; and large platforms, with hand railings, make inspection and repair easy and free from hazard. Fuel oil is used in the kettles and is atomized by means of air at two pounds pressure—a rotary compressor furnishing the air. Compressed air is also utilized in the

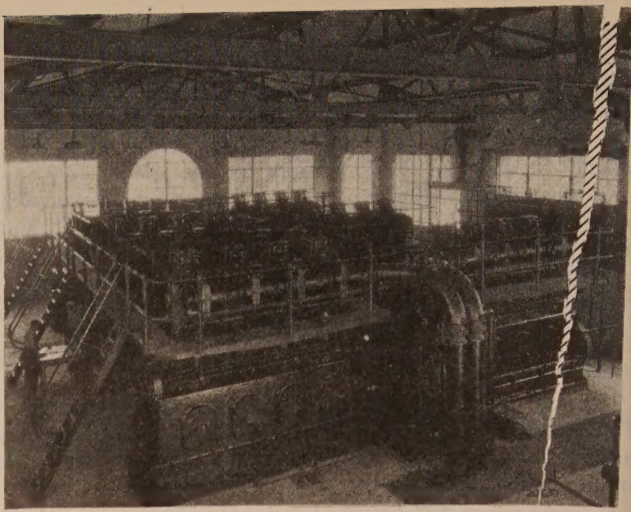


Fig. 2—The 3-unit, 2400-h p. oil ine power plant which is the primary source of energy rired at the quarry, the crusher and the mill

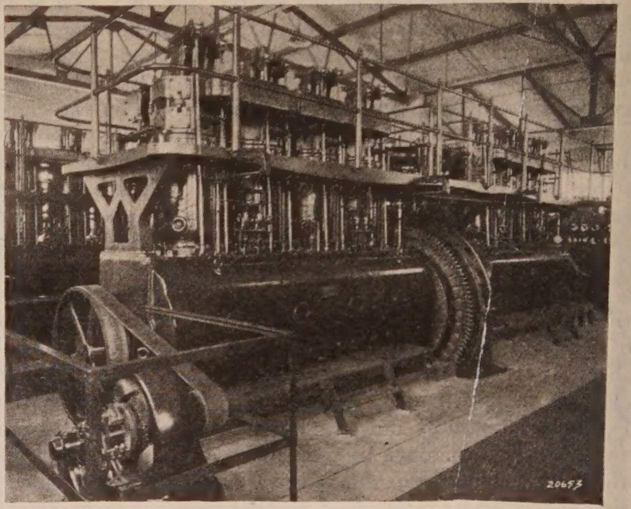


Fig. 3—Interior view showing fuel pumps and valve mechanism of No. 2 engine, one of the th800-h. p. type "PR" oil engines in plant of Pacific Pord Cement Co., Gerlach, Nevada. This view also shows the d exciter

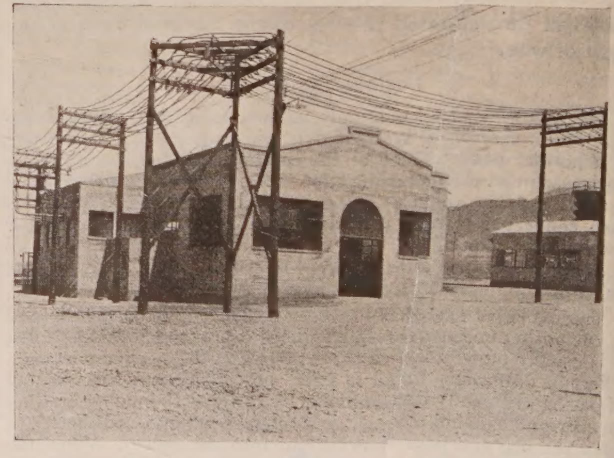


Fig. 4—Power house of Pacific land Cement Co., Gerlach, Nevada. In this plant there aree 800-h. p. type "PR" oil engines direct connected to altern g current generators. One electric motor driven 6-in. strolass "ER-2" air compressor furnishes starting air and one "ER-1" air compressor for general pneumatic tool serviceee 2½ DV Cameron pumps for circulating water service

mill and the machine shop for pumping oil by means of displacement pumps, for aerating material, and for other general services.

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[1] Cement Mill Section of CONCRETE, December, 1923, page 101.

All machinery about the mill is driven by 440-volt, 3-phase, electric motors; and the power required throughout the plant is generated by means of three 8-cylinder, 800-h. p., Ingersoll-Rand, solid-injection, Diesel engines, each connected to an electric generator. These engines use heavy fuel oil; and they have made good every guaranty given by the Ingersoll-Rand Co. in the specifications. As the climate in the region covers a wide range of temperatures—from 40° F. below zero in the winter to 115° F. above zero in the summer-time—open-air construction was used the better to radiate heat from the conductors.

The Pacific Portland Cement Co., Consolidated, also operates a plaster mill at Plaster City, Calif., and two portland cement plants, one at Cement and the other at Redwood City, Calif.

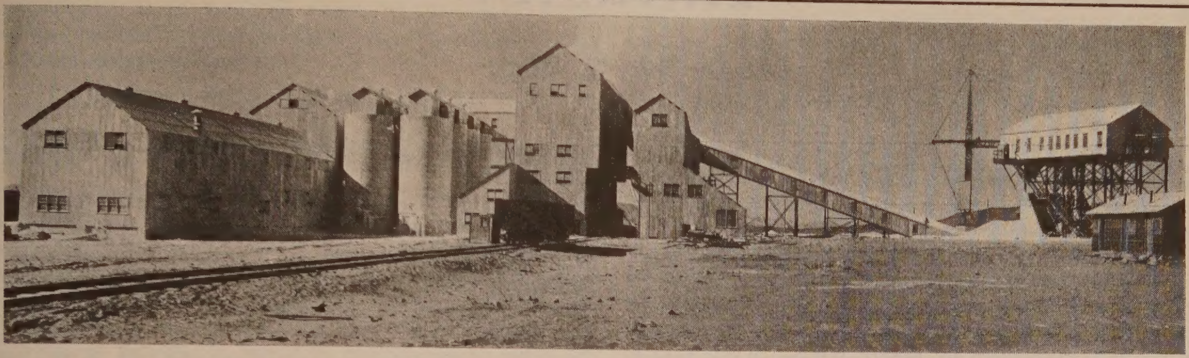

Fig. 1—Gerlach mill where the gypsum is ground and calcined to make various kinds of plaster

British Cement Competition

By H. C. Badder

London, England

During 1923-24 some efforts were made to form a British Association of Cement Manufacturers to promote the use of cement for the proposed great roads and housing schemes. This attempt failed to materialize, and a few of the 30 independent cement companies do much advertising or send out much printed matter as propaganda.

The Associated Portland Cement Manufacturers' Limited, with their subsidiary branch, The Cement Marketing Co., Ltd. control, some 25 cements works and have opened cement depots all round the British coast, forwarding cement in their own ships and barges and are thus in strong competition with the local cement companies. The Association had at one time a large export trade but this is nearly lost owing to the development of cement manufacture abroad, and while sales are good in Britain high capitalization prevented the payment of ordinary dividends. Matters came to a head last July and the Association was reorganized, General Stanley and some six other directors resigned and P. M. Stewart accepted the chairmanship of the association upon the condition that new directors, with industrial and administrative experience, but not hitherto connected with any cement works, should be elected to the board of directors. The first result was that arrangements were made to modernize cement plants nearly obsolete by reconstructing them and last March, at Northfleet-on-the-Thames, a new works was commenced to have a capacity of manufacturing 10,000 tons of cement per week, this quantity being about equal to one-sixth of the total cement production of Great Britain.

The second result was the formation of a new publicity bureau under the direction of Brig.-Gen. A. C. Critchley, C. M. G., D. S. O.; one of the new directors, who is a Canadian, and who, since the War, has been investigating industrial opportunities in Mexico and Central America, before joining the Association.

The Bureau is formed to educate the public to the merits of British portland cement by means of newspaper advertising and by providing free advice and assistance to users. The old Concrete Utilities Bureau that exhibited types of finished concrete work at exhibitions and agricultural shows has been merged into the new Bureau and it is also proposed to organize and establish traveling experts prepared to visit any locality and give help and advice with such questions as the construction of concrete houses, roads and bridges, the use of concrete on farms and estates, the chemical and physical testing of aggregates and the artistic possibilities of concrete. Not much is known of these activities as yet. Some advertising has been done, and a concrete house was erected at the Ideal Homes Exhibition held recently. More attention has been paid to gaining publicity for their "Rapid Hardening" brand of portland cement for which they claim 7,810 lbs. per sq. in. for a 4:2:1 concrete at 24 hours. It is sold at $25.00 per ton ex works. They also offer an aluminous cement made at the Magheramorne works near Belfast, Ireland, sold as "Lightning" brand in competition with "Ciment Fondu" brand manufactured in England by the Lafarge Aluminous Cement Co., Ltd.

The old Concrete Utilities Bureau certainly developed the manufacture of pre-cast concrete units in Britain, but this work is not very flourishing, partly because only small capital is invested in it, and much of the work is poor in quality. What the new Bureau will achieve with its experts remains to be seen. No doubt the methods in vogue in the United States will be copied.

G. & T. Earle, Lt., manufacturers and sole proprietors of Lead Sealed Pelican Brand of Earle's cement, Wilmington, Hull, England, has acquired the work business and goodwill of the Humber Portland Cement Co., Ltd., with former offices at Dalton St., Hull, and will continue to manufacture the Humber brand of portland cement. The Earle company has announced that all outstanding accounts for goods and supplies will be payable to that company of which F. Gibson is director and secretary. W. Field Till who was the sales director of the Humber Portland Cement Co., has joined the Earle company and the same policies will be continued as before the voluntary liquidation of the Humber company.

Manufacturing Problems of Cement Industry

By John J. Porter

First Vice President and General Manager, Security Cement & Lime Co.

From the copyrighted *Transactions* of the American Institute of Mining and Metallurgical engineers issued with *Mining and Metallurgy*, January, 1925.

The requirements of the standard specifications under which portland cement is sold have materially increased within the past 10 years, but practically all companies are now furnishing cement better than these requirements; in some cases exceeding them by nearly 100%. From a sales standpoint, it is desirable to have a product that is uniform to a high degree and free from occasional quality troubles. A failure in quality, even if it affects only a few hundred barrels out of a yearly output of a million or more, is apt to be talked about in the trade and to affect the salability of the entire output. For these reasons, there has recently been great activity along the lines of quality control and improvement; and some of the most interesting problems of the industry are in this field.

From the manufacturing standpoint, the quality of cement is chiefly a matter of uniform and proper chemical composition of the raw mix fed to the kilns plus proper burning in the kilns; the fineness to which the cement is ground, the proportions of gypsum, the method of seasoning, and the like are contributory factors.

Uniform chemical composition of the raw mix has been one of the most difficult problems to solve. Most plants will use from 1000 to 3000 tons of rock per day and in but few cases is this material as it lies in the quarry even approximately uniform in composition. The problem, then, is to quarry and mix this raw material in such a manner that every handful passing through the kilns will have practically the same analysis as every other handful. To accomplish this purpose there are two methods of preparation: the wet process and the dry.

In both of these processes, a stone storage is the first requisite for a successful plant. This storage may handle the stone before or after crushing; its capacity may vary from two to three days' up to several months' supply, but it should be so designed that it can be filled as desired by the chemist and drawn at such points as will give a mixture of the various kinds of stone coming from the quarry and a reasonably uniform material going to the mill. The size of the storage and the exact method of handling should be varied according to the nature of the material.

Following the stone storage, the two methods of manufacture diverge. In the wet process, the raw material is ground with enough water to make a thick slurry, which is stored in tanks and stirred so that the contents of any one tank will be absolutely uniform. The chemist, after analyzing each tank, can then mix the slurry so as to obtain a raw material for the kilns of practically uniform composition. In the dry process, the storage tanks are arranged so as to be filled in rotation and drawn together, thus ironing out the variation occurring from hour to hour in the stream of material; the final stage in this mixing process is usually storing in what are known as silo tanks, the ground raw material before it is fed to the kilns. As each tank is filled, it is sampled and analyzed; two or more of these tanks are then drawn together in proportions to give exactly the composition required in the kiln feed.

After many years of experience with these processes there is a wide difference of opinion among cement-mill operators as to their relative merits. It is generally conceded that it is somewhat easier to obtain uniformity of mix with the wet process and there is some advantage in the cost of grinding the material wet. On the other hand, there is a decided economy of kiln fuel in the dry process and, in the writer's opinion, the full possibilities of obtaining uniform material through use of a series of mixing bins in the dry process are not generally appreciated or realized.

Effect of Variation in Chemical Composition

The raw material fed to the kilns must be uniform in composition and of the right composition. This might seem to be a simple matter, but small differences in the proportions of the lime, silica, alumina, iron, and magnesia are inevitable; further, what is the right composition at one mill is not necessarily the right composition at some other. In other words, the proper chemical composition for high quality cement apparently depends, to some extent, on the nature of the raw materials being used. The reason for this fact, if it is a fact, and the exact relations involved are not well understood, but it is probably these factors, which can only be worked out by experience, that are largely responsible for the quality difficulties of so many plants during the first year or two of their operation.

The effect of some of the occasional, but less common, constituents of limestone on the quality of cement is not thoroughly understood. It is believed that the presence of appreciable amounts of phosphoric acid may, at least under some conditions, affect the quality of the cement. Whether this trouble is inherent in this element or whether it is due to its combining with a certain proportion of the lime and thereby making it necessary to change the proportions of the mixture is not known. It is thought that considerable quantities of potash and soda in the raw material may also affect the quality of cement, although this has never been proved and there are only indications to that effect.

Importance of Correct Burning

The degree of burning is a quality factor of the greatest importance; and is the one thing, perhaps, most frequently causing trouble. As fuel is one of the major items in the cost sheet, there is naturally a tendency to economize as much as possible in its use; occasionally this leads to a degree of underburning that affects the quality of the cement made. This is particularly the case as there is no satisfactory method of measuring or recording and, hence, of standardizing the degree of burning. The methods generally used to check up burning are visual inspection of the clinker as it issues from the kilns and a test similar to the soundness test on cement made on the ground fresh clinker. Attempts have been made to use radiation pyrometers to measure the temperature of burning, and in that way control it. But, the burning of clinker is a function of time as well as temperature; in fact, it is by the time of exposure that the degree of burning is ordinarily controlled, the temperature being nearly constant and fixed by the nature of the fuel and the conditions of its combustion. There is a wide range between the minimum degree of burning which will just get the cement past the specifications, and the maximum degree which will produce the best cement that can be made from a given material. Any burning in excess of the latter is overburning; overburned clinker will grind into perfectly good cement, the only objection to it is from the standpoint of cost. There is a danger in underburning, however, and one of the most interesting and important problems of the industry is to establish means of control that will enable the operator to know for a certainty when he is burning at the most economical point.

Research Work Now Being Done

An interesting problem is the possibility of producing a supercement, one having a materially greater strength than is now the practice, by carrying the lime in the mixture a little higher than at present, burning correspondingly harder, and grinding much finer. Much work has been done along this line, especially in Germany, but there is much more work to be done. Within the past year, a research organization, supported jointly by the Portland Cement Association and the Bureau of Standards, has been established to study the fundamental chemical problems of cement. It is hoped that the result will be a better understanding of many things that are now puzzling the practical operating men of the industry.

Factors Affecting Cost

The principal factors in the cost of making cement are in the approximate order of their importance, labor, fuel, power and repairs; the principal operations into which these factors enter are quarrying, crushing, grinding and burning. Rapid progress along the line of cost reduction has been made during the past decade. Ten years ago, somewhat over one-man-hour of labor was required to make a barrel of cement; at present the average is only a little over one-half man-hour, as a result of the use of larger units, improved machinery, and the standardization of methods. The introduction of waste heat boilers has also resulted in a material saving in cost at many plants. With this equipment, power can be generated at a cost of from 0.6–0.8 c. per kw.-hr., a considerable reduction from the usual cost when using coal fired boilers. In other words, the use of this equipment has reduced the total fuel consumption approximately 50 lb. per barrel.

The effect of this technical progress is to be seen in the relatively lower price of cement, compared with other structural materials. There was, of course, a great increase in the price of all building materials during the war and in the subsequent period but statistics compiled by Government Bureaus show that from 1912 to 1921 the price of portland cement increased less than that of any of the large number of materials used in building and construction, and very much less than the average of all of them.

The most interesting and valuable work on the grinding problems of the cement industry has been done by the researsh engineers of the Conservation Committee of the Portland Cement Association. This work, so far, has been confined to the grinding of clinker in tube mills but it has shown the fallacy of many generally accepted ideas. For example, it has been shown that the ratio of lime to silica, iron, and alumina is the one chemical factor affecting grindability, and that the silica, iron and alumina ratio, which for so long was considered important, is really of no effect. Another exposed fallacy is the effect of seasoning on grindability. The temperature of the clinker is of great importance but starting with cold clinker, exposure to the elements, resulting in increase in "loss on ignition," is detrimental to grindability.

A number of important problems relating to grinding remain to be solved. The exact operation of temperature, in its effect on grinding of clinker, is not understood. We do not know if the data relating to grindability in tube mills can be applied bodily to other types of mills or whether it will be necessary to modify these data for each kind of grinding mill. Neither do we have adequate and systematic data regarding the relative efficiency of the various types of grinding mills on the various materials that must be ground. Experience in the industry would seem to indicate that certain mills may work efficiently on one material and may be very unsatisfactory at another location and on other materials.

The burning of the cement clinker is the heart of the manufacturing process and some of its most interesting and important problems are found here. Since the adoption of the rotary kiln, tremendous progress has been made in burning efficiency; but our knowledge of the process is still largely rule-of-thumb and there is great need for a systematic study of kiln operation and the reduction of its various factors to a quantitative basis.

There is no really satisfactory expression for kiln output in relation to kiln size. Attempts have been made to rate output on the basis of kiln volume, shell area, area of cross-section at the burning zone, etc.; none of these methods will hold for all sizes of kilns. It is self-evident that for a given material the output will, within certain limits, be proportional to the amount of coal that can be burned per unit of time; or, in other words, to the area of cross-section in the burning zone. It is also evident that the longer the kiln, the better prepared will be the material when it reaches the burning zone; hence, less fuel will be required per unit of output and the output will be larger for a given rate of combustion of fuel. It is also evident that the feed end of the kiln must have an area sufficient to pass the gases of combustion at the available draft. It should be possible to work out the relationship of these various factors and to devise a formula that, for a given material and a given draft, will accurately express kiln output in relation to dimensions.

A somewhat related problem is the relationship between output and fuel economy. For very low outputs, radiation loss, being constant per unit of time, is excessive per unit of output; hence, fuel consumption is increased. For very large outputs, involving a high rate of combustion of fuel, the time of contact and the opportunity for heat transfer between hot gases and incoming material are lessened, hence, fuel consumption is increased. Between these extremes lies the most economical rate of production from the standpoint of fuel economy. This rate no doubt varies somewhat for different materials , but quantitative data, which are almost totally lacking at the present time, would be of great value to the industry.

One of the most interesting problems is the effect of small variations in chemical composition and nature of raw materials on the output and fuel economy of the rotary kiln. It might be supposed that with a constant chemical composition all materials would burn the same, but this does not seem to be the case. Apparently, the form in which the silica, and perhaps other elements, is present in the raw material has a most important bearing on the ease of combination; as a result, at different plants the same size kiln produces widely varying outputs with widely varying fuel economy. Even at the same plant, in many cases, the output and fuel consumption vary from week to week and from month to month, according to the strata being taken from the quarry. There is great need for a simple test for "burnability" of raw materials so that these differences can be measured and predictions made in advance of the utility of new materials. Such a test would also be of great use in existing plants in adjusting a three-component mix to the most efficient point.

It is self evident, and has been known for many years, that the fineness of grinding of the raw material affects the ease of burning but there are not sufficient quantitative data to enable the manufacturer to calculate closely the most economical point of grinding, every thing being considered. The problem of the effect of fineness of coal is being solved by the engineers of the Conservation Committee of the Portland Cement Association. It has long been supposed that the finer the coal the greater is the fuel economy, but the committee has found that in many cases there is no advantage in grinding finer than approximately 50 % through the 200-mesh sieve. Under usual operating conditions, this fineness is sufficient to burn perfectly all the coal; and when all heat units have been released, obviously there is nothing further to be gained. An incidental advantage of the use of coarser coal is the greater ease of handling. In some plants, the indirect saving through relative freedom from coal floods and spontaneous combustion in coal bins is an important factor. On the other hand, the use of coarse coal has not been satisfactory at some plants where it has been tried. There are, evidently, certain conditions necessary for its success that have not been determined, but the problem will no doubt be completely solved in the near future.

There is, apparently, no such well-defined critical temperature in the operation of cement burning as exists in the iron blast furnace. Nevertheless, a high temperature is necessary and sufficient heat units must be furnished at this high temperature to make up for the radiation losses and heat carried out in the clinker. A number of experiments looking toward higher temperatures of combustion, principally through the use of preheated air, have been tried; while the results are conflicting, there seems to be some advantage in this practice. A mathematical study, similar to that made by Johnson[1] for the iron blast furnace would be a valuable guide to work in this field.

Along the same line is the problem of the insulation of the burning zone of the rotary kiln. This has been repeatedly tried; the failure of the experiments was due to the difficulty of holding the lining. Ordinary firebrick lining owes its stability to the cooling of its outer surface by radiation from the kiln shell, and when this is prevented, its life is only a matter of a few hours. No manufacturer, so far as known, has tried a lining of radically different composition and more refractory character in combination with an insulating material in the burning zone.

The industry still has much to learn concerning kiln linings. It is customary, in rotary-kiln operation, to form a coating of fused clinker on the surface of the firebrick lining, which coating forms the real working surface. The life of the lining is, in most cases, dependent on its ability to hold a coating and generally speaking, refractories high in alumina are the most satisfactory. There is a wide difference in cost between the various brands of high alumina kiln blocks and, as the action of the coating differs with the various materials being burned, each plant must work out the problem of the most economical lining for itself. With our present knowledge this is a long and expensive procedure because we have no correlation of the results of laboratory tests with the results of actual experience.

A most important problem in connection with kiln operation is that of getting a perfectly uniform feed of both raw mix and powdered coal. When feeding dry raw mix, the amount passed per revolution of the feed screw varies within wide limits according to the condition of the material. Mix that has been freshly ground is still warm, contains a large amount of entrained air, and will weigh much less per cubic foot than mix that has been allowed to stand for some time in storage tanks and is therefore cold and relatively free from air. Moreover, mix feeds more freely into the feed screws while the tank above the screw is being filled; also the rate of feed varies with the height of material in the tank above the screw. Various devices are in use to prevent flooding of raw material entering the kilns but none give that perfect uniformity in rate of feed which is essential to the best output and fuel economy.

A similar condition prevails in respect to the feeding of the pulverized coal, and there is the additional disadvantage that any variation in the rate of feed makes it impossible to adjust the air supply to the most efficient point for perfect combustion. In addition to the fluctuations occuring from hour to hour, there is a fluctuation from second to second due to the action of the feed screw, some coal being pushed into the blast pipe each time a conveyor flight moves across the feedpipe outlet. Double- and treble-flight conveyors are used to lessen these intervals but even then, in many cases, there is an appreciable puffing of coal at the nozzle of the burner pipe resulting in a quick succession of too much and too little air for perfect combustion.

Dust Collection and Prevention

Among the most important mechanical problems of the cement industry is dust collection or prevention. This is important from the standpoint of working conditions at the plant itself and, in many instances, from the standpoint of community nuisance. There are many sources of dust in the cement mill but the more important, in the order of their importance, are the kiln stacks, dryer stacks, grinding mills, crushers and conveyors. There is no gainsaying the fact that the wet process has a material advantage from this standpoint. Dryer dust is eliminated, with the exception of the coal dryers, and dust from raw grinding is entirely eliminated. From the kiln stacks, the dust loss in the wet process should be, and usually is, materially less than in the case of the dry process, although this is not always the case.

Several types of bag filters and centrifugal dust collectors are available in connection with grinding mills, crushers, and conveying machines. Generally speaking, they work with a fair degree of efficiency, except where the dust is associated with a certain amount of steam. For kiln stacks, Cottrell electrical precipitators are satisfactory, although relatively expensive in both first and operating cost. In a number of cases, centrifugal collectors have been installed following waste-heat boilers. They usually catch only 60 to 80% of the dust, but are relatively inexpensive in installation and operation, and, hence, are most satisfactory where they will answer the purpose. There is no satisfactory dust collector for use on dryer stacks, the combination of steam and dust being particularly hard to handle. A few attempts have been made to scrub these waste gases with water spray, but this procedure is only feasible where an abundant supply of water is available.

Among the multitude of other problems are those having to do with the life of grinding mill and conveyor parts. The rapid growth of the cement industry has only been possible through the development of grinding machines permitting the pulverizing of the enormous quantities of materials required. These materials are highly abrasive, replacements of mill and conveyor parts form a large item in the cost and the problem of better materials is important. This problem is primarily one for the manufacturers of mill machinery but, in view of the enormous variation in the life of different lots of roll heads, grinding rings, etc., the cement industry may be forced to delve into these matters and work out its own metallurgical specifications.

The Gulf States Portland Cement Co., of Demopolis, Ala., has just completed the installation of a new 8-ft. x 125-ft. kiln. Another kiln 9-ft. x 125-ft. will be installed by July 1st of this year. The addition of these two kilns will increase the capacity of the plant 2000 bbls. per day. The plant will be equipped with hydro-electric power by or before October 1st of this year, which will greatly facilitate the operation of the plant, as the present power plant is inadequate. The enlargement will do away with some of the old machinery and kilns, and all future improvements will be made with the view to eliminating the small units.

The popularity and demand for Warrior cement has caused this enlargement. The output of the plant has gradually increased over the past five years, and at present the demand is in excess of the output.

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[1] *Trans.* (1906) 36, 454.

Laboratory Design Contest Ends in Tie

The contest for ideas in laboratory design conducted by The Great Western Portland Cement Co., was closed on May 1st, and adjudged on May 15th.

The judges: F. V. Reagel, engineer of materials, Missouri State Highway Commission, Jefferson City, Mo.; C. H. Scholer, State testing engineer, Kansas State Agriculture College, Manhattan, Kansas; H. H. Blaise, superintendent The Great Western Portland Cement Co., Mildred, Kansas; and Robert S. Schultz, Jr., consulting engineer, The Great Western Portland Cement Co., Kansas City, Mo., had such difficulty in deciding between the various plans submitted that it was found impossible to award the prize to any one man and they accordingly declared the contest a tie between E. H. Schwartz, chief chemist, Cayuga Operating Co., Inc., Portland Point, New York, and E. P. Newhard, chief chemist, Clinchfield Portland Cement Co., Kingsport, Tenn.

The ideas and designs submitted by each of these men covered very complete cement testing laboratories and it is anticipated that they will be of material assistance in the design of the new laboratory to be built by The Great Western Company at its Mildred, Kansas, plant.

The design submitted by Mr. Newhard was in the form of a complete report on laboratory layout and equipment profusely illustrated by photographers showing details of the equipment and its arrangement. Particular attention was paid to lighting and the arrangement of accessory equipment to expedite testing work.

The design submitted by Mr. Schwartz was equally complete including floor plans and sketches with very complete detailed descriptions of the proposed equipment.

The designs submitted by the other contestants were almost equally complete and it was extremely difficult to judge between them. Undoubtedly a number of the ideas shown in these designs will be incorporated in the new laboratory.

An interesting feature of all designs submitted was the general agreement as to the various types of equipment desirable for cement testing work and also the space necessary for proper arrangement.

The Great Western Portland Cement Company expects to begin construction of this new laboratory as soon as the best ideas submitted can be worked into a design suitable for the requirements of this particular mill.

The building will be of cinder block and concrete construction and concrete will be used as far as possible in construction of tables, closets, etc.

An unusual feature of the new laboratory will be the space and equipment provided for customer's testers, particularly the resident testers of the Missouri State Highway Commission.

Portland Cement in April, 1925

Statistics prepared under the direction of Ernest F. Burchard, of the Department of the Interior, Geological Survey, based mainly on the reports of producers of portland cement show that April production and shipments were the highest for that month in any year. Stocks decreased slightly but were higher than ever before except at the end of March, and are equivalent to the consumption for nearly 1.4 months at the present rate.

Production of portland cement in the various commercial districts totaled 13,807,000 bbls. for the month of April as compared with 11,726,000 bbls. in 1924. Total shipments for April amounted to 14,394,000 bbls. for 1925 and 12,771,000 bbls. for 1924. Stocks at the end of the month of April were reported at 19,882,000 bbls. compared with 17,159,000 bbls. in 1924. The revised report gave stocks at the end of March 1925 as 20,469,000 bbls.

CAPACITY

The portland cement manufacturing capacity of the United States by commercial districts in 1923 and 1924 is estimated as follows:

District	Estimated capacity	
	1923	1924(*a*)
Eastern Pennsylvania, New Jersey, and Maryland	42,195,000	43,831,000
New York	8,306,000	9,107,000
Ohio, Western Pennsylvania, and West Virginia	15,090,000	16,187,000
Michigan	9,346,000	11,333,000
Wisconsin(*b*), Illinois, Indiana, and Kentucky	22,296,000	23,532,000
Virginia, Tennessee, Alabama, and Georgia	10,719,000	12,889,000
Eastern Missouri, Iowa, Minnesota, and South Dakota(*b*)	16,580,000	17,418,000
Western Missouri, Nebraska, Kansas, and Oklahoma	11,795,000	12,277,000
Texas	4,642,000	5,048,000
Colorado and Utah	3,025,000	3,205,000
California	12,594,000	14,477,000
Oregon, Washington, and Montana	5,270,000	4,917,000
	161,858,000	174,221,000

(*a*) Subject to revision.
(*b*) Wisconsin and South Dakota first included in 1924.

IMPORTS AND EXPORTS

The following figures on imports of hydraulic cement and exports by countries and by districts in March, 1925, are compiled from records of the Bureau of Foreign and Domestic Commerce, and are subject to revision. Imports and exports in April 1925 are not available.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES, AND BY DISTFICTS, IN MARCH, 1925

Imported from	District into Which Imported	Barrels	Value
Belgium	Massachusetts	12,117	$19,483
	Los Angeles	53,033	85,929
	San Francisco	20,083	26,369
	Washington	2,341	3,327
	Total	87,574	135,108
Canada	Buffalo	42	122
	Washington	54	188
	Dakota	59	184
	Total	155	494
Denmark	Porto Rico	40,052	60,279
France	San Francisco	6	16
Germany	New York	6	4
	New Orleans	3,062	3,194
	Total	3,068	3,198
Japan	Hawaii	322	396
Norway	Maine	3,390	4,658
	Massachusetts	29,221	45,651
	New Orleans	12,463	22,112
	San Francisco	7,780	49,050
	Washington	11,915	18,995
	Hawaii	22,108	34,882
	Total	86,877	175,348
	Grand Total	218,054	374 839

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES, IN MARCH, 1925

Exported to—	Barrels	Value
Canada	1,249	$5,821
Cuba	15 190	36,368
Other West Indies	4,939	13,497
Mexico	14,150	38,303
Central America	3,779	11,617
South America	22,814	76,068
Other countries	3,127	18,736
	65,248	200,410

The Chee Hsin Cement Co., Tientsin, and other cement manufacturers of cement in China, started a big Centennial Celebration Convention in honor of Joseph Aspdin, the British inventor of cement, on April 17 at Tienstin. This is a significant gathering and has attracted attention all over the world. M. H. Chou, formerly with the Ta Hu Cement Co., is now connected with the Chee Hsin Cement Co.

National Lime Convention

As this issue of Concrete goes to press, the seventh annual convention of the National Lime Association is under way at Briarcliff Lodge, Briarcliff Manor, N. Y. The program for the four days, May 26-29 inclusive, includes much interesting material in the lime and allied fields, and indicates many activities on the part of the lime manufacturers.

In his annual report, G. J. Fink, chemical director, stated that the generous support of the manufacturers had made it possible to continue all of the activities outlined at last year's convention and to expand some of them in many directions. After recounting some of the work of the past year mentioning the more outstanding facts, the following recommendations relating to the chemical activities for the future were submitted.

1. Continuation of all activities of the past year.
2. Increased facilities, either direct or indirect, for chemical field work.
3. Enlargement of the scope of the Fellowship work including both additions to the numbers of Fellowships and increased endowments in certain cases.
4. Provision for an extensive investigation of the field for lime products not now manufactured by members.
5. Increased facilities for cooperation with manufacturers in their efforts to improve processes and products.

The agricultural activities of the association were summed up by R. C. Towels, soil technologist. Tests and research work have been conducted in a number of states and unofficial reports indicate that all over the country there has been a larger consumption of soil liming material this year than during any spring season for several years.

In his construction report, R. P. Brown, construction engineer cited that special attention has been called to the correlation of laboratory experiments and field practice. Considerable work on the cause and prevention of efflorescence of brick and stone masonry is under way at the Bureau of Standards. This work is of interest to the lime industry. Bond tests are also being watched in which various kinds of mortars are being compared. The new developments in the construction industry each year afford additional opportunities for service to the industry.

Charles Warner, of the Charles Warner Co., Wilmington, Del., was elected president for the next two years, and J. J. Urschel, of the Woodville Lime Products Co., Toledo, Ohio, was elected vice president.

June to Be "No Accident Month" at Cement Mills

"The chance taker is the accident maker."

This is the keynote of "No Accident Month," which is to be observed in June with a safety campaign by nearly all the cement plants in the United States and Canada, making the first time that an entire industry has attempted such a movement.

The drive to dodge danger will be waged aggressively among the 40,000 employees of about 135 cement plants in this country and Canada as a means of reducing the already low accident rate as much as is humanly possible during June. Experience with similar campaigns in individual companies has shown that the safety principles emphasized will be long remembered by the workers.

"The best safety device is a careful man," is the belief of those sponsoring "No Accident Month," and with this in mind they are concentrating on educating the workman to protect himself and fellow workers.

The Portland Cement Association Safety Trophy was awarded the Lehigh Portland Cement Co.'s Mitchell plants for the best safety record made in 1924.

Portland Cement Association Meeting

Representatives of the 89 cement manufacturers, members of the Portland Cement Association, closed the three-day session of their Spring meeting, May 20, at the Biltmore Hotel, New York. Attendance both from the standpoint of the companies represented and individuals registering, constituted a record among the spring meetings of the Association.

As has become the custom, the first day was devoted to meetings of standing committees for the purpose of discussing and preparing the usual committee reports for presentation at the business session on Wednesday, May 20. On Tuesday the general session was held for the discussion of technical problems and mill practice related to the manufacture of portland cement. At this session, reports of the Committee on Accident Prevention and Insurance, Committee on Conservation and Committee on Technical Problems were presented and discussed. The importance of all three of these Committee activities on the advancement of the cement industry has become increasingly apparent from year to year.

Among other interesting features of the Tuesday's session were two papers, entitled "Economic Influence of Lubrication on Cement Mill Production," by J. A. Marland, technical manager, Chicago branch, Vacuum Oil Co.; and "Rings in Cement Kilns," a paper by W. J. Maytham, consulting engineer, Northwestern States Portland Cement Co. The latter disclosed a number of interesting experiences in cement plant operation as to the cause and prevention of ring formation.

About two years ago, the Association decided to offer a trophy each year to the plants that had the best record in safety during that year. For 1924, the trophy was awarded to the Mitchell, Ind., plant of the Lehigh Portland Cement Co., whose record was 1.5 days lost per 100,000 man-hours worked.

On Wednesday, the usual business session of the Association was held, which, in general, reflected an optimistic attitude as to the year's outlook for the construction industry.

100% Safety Record at Universal

A 100% record for industrial safety was achieved in April by the Universal Portland Cement Co., according to a report recently made public. All its mills, located in various sections of the country, operated during April without having a single employee lose any time on account of accidents.

"With thousands of workers employed, manufacturing over five million sacks of cement last month and with operations speeded up to meet the heavy demands of spring construction without the occurrence of any accident, is a gratifying result of years of safety education," declared B. F. Affleck, president of the company.

"Cement manufacture, in common with many other industries, is a hazardous occupation unless constant care is exercised by both company and employees.

"Yet, despite these hazards and despite the fact that employees include many nationalities and languages, making group instruction difficult, the use of modern industrial safeguards to protect the health and life of workers and the constant safety education that has been conducted for 25 years, have resulted in the 100% perfect record established last month.

"The month of May marks the twenty-fifth anniversary of the organization of the Universal Portland Cement Co.," concluded Mr. Affleck. "We believe there is no feature of this 'birthday' observance more gratifying than the ability publicly to announce this 100% record of safety in industry."

Men and Mills

Notes from the Field

Capacity production during 1295 is indicated by present conditions, president Herbert E. Steiner of the Coplay Cement Manufacturing Co., told stockholders at their recent annual meeting at Coplay. The stockholders inspected the Coplay mills which have undergone extensive improvements.

H. A. Reichenbach, of Allentown, Pa., recently appointed superintendent of the Nazareth Cement Co., Nazareth, was formerly with the Alpha Portland Cement Co., in Easton and with the Fuller Engineering Co., Fullerton.

Cement is moving out of the Lehigh district in larger quantities than last year at this time, indicating a record production. General conditions are quite satisfactory for an extraordinary volume of business, freight cars being in plentiful supply for shipments.

The Batesville White Lime Co. has recently completed the construction of a lime plant at Limedale, near Batesville, Ark., and fired the three big kilns for the first time. The plant has a capacity of 600 bbls. for burnt lime products a day. The new lime will be marketed under the brand of Polar Bear.

Superintendent R. R. Dorland of the Devil's Slide cement plant at Devil's Slide, Utah, states that in spite of the fact that the contract for supplying cement for the construction of the American Falls dam was not awarded to his plant, they will be able to continue operations during the coming season on a half capacity basis.

After suspended operations for the past several months, the kilns of this plant were started recently and the plant which at full capacity turns out about 2400 bbls. of cement a day, is now turning out 1200 bbls. daily.

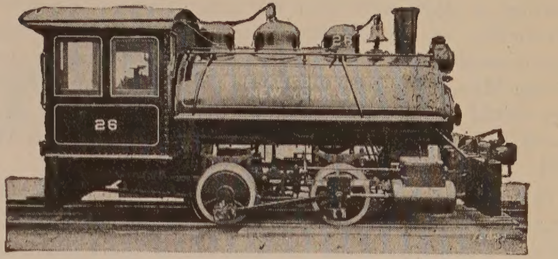
The Sullivan Machinery Co. has appointed Earl E. Miller as manager at its El Paso, Texas, branch office, succeeding R. S. Weiner, who is transferred to the general office in Chicago.

The Golden State Portland Cement Co. which has been taken over by the Riverside Portland Cement Co., Los Angeles Calif., is erecting a steel warehouse to replace the old one at Oro Grande, which was recently destroyed by fire. The building is 45 ft. x 160 ft. and 15 ft. high. It is of steel construction throughout.

The Great Western Portland Cement Co., Kansas City, Mo., has sent out warnings against the use of liquor among its employees during working hours, or on any company car. No employee should offer a drink to another employee during business hours and the company will not pay for any liquor charged on expense account or otherwise. Page Golson, vice-president of the company, issued the instructions.

F. M. Whitfield has been appointed district engineer in charge of Portland Cement Association work in Tennessee, with offices in the Baird-Ward Bldg., 150 Fourth Ave., N. Nashville. The removal of the office from Memphis to Nashville, enables the Portland Cement Association to still further improve its service to its many friends in Tennessee.

The thirty piece band of the Marquette Cement Mfg. Co. broadcasted a complete musical program from the Hummer Furniture Co. station at La Salle, Ill., recently.



"I consider the Vulcan Superior to other makes—"

Here is the opinion of Mr. F. W. Allen, Vice-President of Rodgers and Hagerty, Inc., one of the largest contracting companies in America. This company has fifteen Vulcan Locomotives on various jobs in different sections of the country. The first Vulcan was purchased in 1912.

The Vulcan shown here is an 11-in x 16-in. cylinder, 21-ton, four-coupled saddle-tank type, with automatic couplers and of standard gauge.

Among the big features, according to Mr. Allen, are its simplicity of construction, and low maintenance cost. What Mr. Allen says is typical of what users are saying of the Vulcan Steam Locomotive wherever used — in contracting work, around steel plants, in quarries, mines, etc. The long-lasting capacity of Vulcan Locomotives explains in part why Vulcans once used are always used. The obsession of Vulcan Engineers for refinement of detail and thoroughness of workmanship has placed the Vulcan in a class by itself. The "reason why" for Vulcan popularity is explained in the Vulcan Steam Locomotive Bulletin C. Get your copy.

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VIW LOCOMOTIVES

Indications reported by the Cement Committee of the Atlantic States Shippers' Advisory Board at the sixth regular meeting in April were that the cement industry under the jurisdiction of the Atlantic States Board would require approximately 68,850 cars for the transportation of cement during May, June and July. Of this, approximately 8,600 cars would be required for mills in the New York district and 60,250 cars for mills in eastern Pennsylvania and Maryland.

The bronze trophy, Sentinels of Safety, designed by Begni Del Piatta for the award in the National Safety Competition conducted under the auspices of the United States Bureau of Mines was unveiled at the studio of Daniel Chester French, New York City, on May 20, 1925. The trophy is furnished by the *Explosives Engineer*, Wilmington, Del.

The new kiln just added to the Fort Worth plant of the Trinity Portland Cement Co., was fired for the first time on May 4. Final touches on the construction work were being made and it was anticipated that everything would be completed by June 1.

Construction on the Wabash Portland Cement Co.'s new cement plant near Osborn, Ohio, is proceeding rapidly and a great deal of the concrete foundation is poured and structural steel is being erected. The slurry system consisting of 10 reinforced concrete silos is practically completed and will be followed by the silos, stock house and pack house, all of which are being built by the Spencer Construction Co., Baltimore, Md. L. L. Stone is the designing and construction engineer of the complete plant.

The Spencer Construction Co., contracting engineers, Baltimore, Md., has completed operations at the Clinchfield Portland Cement Co.'s plant at Macon, Ga., where manufacturing operations were scheduled to begin on May 15 under the direction of F. Guenther, Jr., general manager, under whose supervision the plant was designed and built. The Spencer company carried out the construction of the reinforced concrete silos, stock house, pack house, and bag house units.

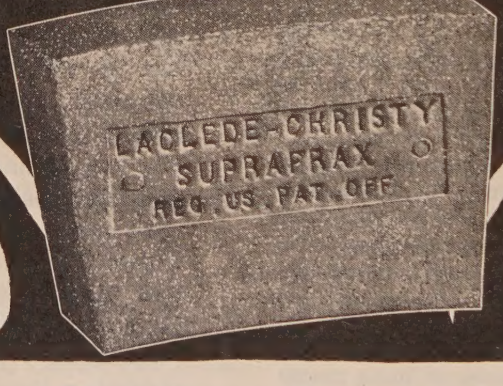
Present developments with reference to the Standard Portland Cement Co.'s plant at Painesville, Ohio, indicate that if the present rate of construction is maintained, the plant will be ready for operation in July of this year. Most of the miscellaneous foundations are in, the slurry system is poured and construction of the reinforced concrete stock, pack and bag houses has been started by the Spencer Construction Co., Baltimore, Md., and most of the structural steel has been erected. Operations were started at this point under the name of the Ohio Portland Cement Co., Inc., in February of this year, and the progress has been very rapid. The Fuller-Lehigh Co. are the engineers for the Standard plant, with M. B. Jones as resident engineer.

The W. W. Sly Manufacturing Co., Cleveland, Ohio, recently opened an office at 215 Security Bldg., 44 Vernon St., Springfield, Mass., Daniel L. Harris being sales engineer in charge.

The Signal Mountain Portland Cement Co., Chattanooga, Tenn., contemplates installing a waste heat boiler plant, in connection with kilns and the building of a power house to generate electric power for the entire plant and quarry operation and has a $20,000 office building under construction, according to a recent report.

At a recent meeting of the board of directors of the Petoskey Portland Cement Co., J. B. John resigned as general manager and J. L. A. Galster of Petoskey was named to fill the vacancy. Mr. John will continue as president of the company.

LACLEDE-CHRISTY SUPRAFRAX



The Money Saving Rotary Kiln Liner

A 6-inch Suprafrax Liner will give longer service than an ordinary lining 9″ thick. Thus, a Suprafrax Liner weighs ⅓ less; requires less power to actuate the kiln; minimizes production losses and *increases your kiln capacities.*

A recent report from one cement plant says: 'Oil fired kilns, wet process. .... liners lasted 28 days; Suprafrax lasted 5 months; best service outside of Suprafrax, 2 months. Suprafrax is only material that will take coating."

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